Space Weather Technical Forecast

Issued on Thursday, 25 July 2024 at 12:42 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of R1 Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity was Moderate in the last 24 hours, with an M3 flare observed at 24/1721 UTC from AR3751. There are currently eleven sunspot regions on the solar disc. The two closely residing spots in the southwest, AR3751 and AR3761, have continued a slow decay. The largest and most complex region, AR3762, is now approaching the centre disk. It continues to exhibit a proliferation of intermediate spots, with perhaps a tenuously weak delta spot present here alongside the well-established delta in the trailing region. All other remaining regions are small or simple.

A weak halo was observed shortly after 25/0025 UTC on Coronagraph and Stereo imagery. While dimming was observed originating from AR3762 near the centre disc, the timing doesn't match (the halo appearing slightly before the dimming), which suggests that this CME is most likely far sided. The spectrometer onboard Solar Orbiter also recorded an estimated X7 at 24/2325 UTC, likely reinforcing the idea of a far-sided event. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Slow wind conditions largely persisted, however with a very small discontinuous increase in the total magnetic field at 25/0730 UTC, was perhaps due a passing transient. The solar wind, as measured by ACE at L1, remained at background levels, between 290-350 km/s. Density was well-below average. The Interplanetary magnetic field (IMF), Bt, was initially Weak but became Moderate after 25/0730 UTC, rising to around 10nT. The north-south component, Bz, was almost entirely positive (northward), peaking +10nT around 25/1015 UTC. The phi angle was largely negative (Towards the Sun) but rotated to become positive (away from the sun) for a time between 25/0500-0900 UTC. The net result of the above solar wind measures was for Quiet (Kp 1-2) geomagnetic indices.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 has returned back to background levels after a period above S1 on 23 Jul following a large far sided full halo CME. High energy electron flux (greater than 2MeV) observed at GOES16 was at Normal Background. The 24-hour fluence was well below Active, with 1.06e6 integrated pfu observed at 25/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of further M-class flares.

Solar Wind /Geomagnetic Activity: No coronal hole fast winds feature in the forecast period. A CME may give Earth a glancing blow late on Day 2 or perhaps early on Day 3 (26/27 July), originating from a long period M2.4 flare close to the southeast limb on 23 Jul. Confidence is low though. Geomagnetic activity is expected to be mostly Quiet with a chance of Unsettled and Active intervals on Day 2 or early Day 3 (26/27 July) and a slight chance of G1/Minor storms.

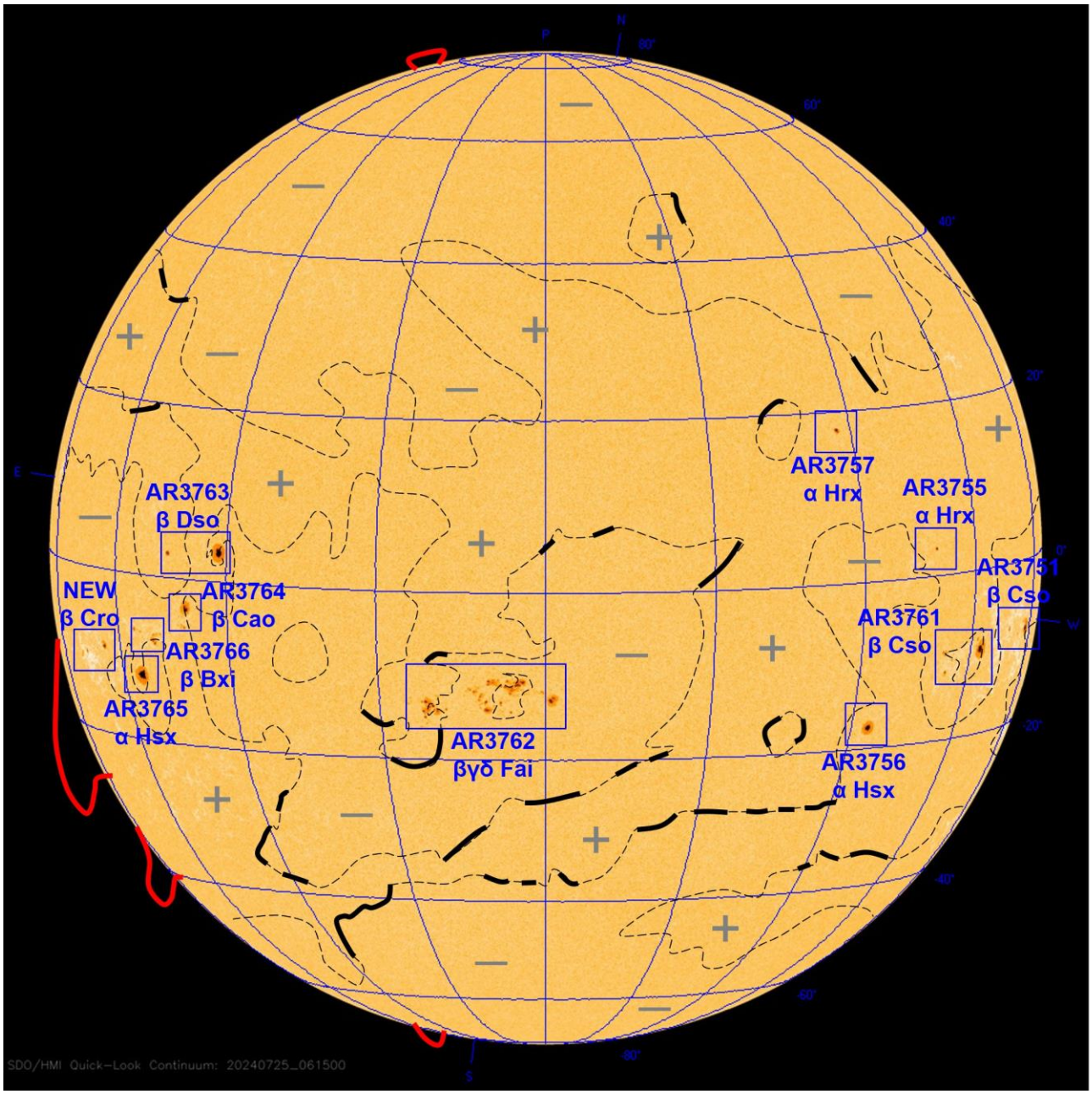
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Energetic Particles / Solar Radiation: High energy proton levels are likely to remain at background levels, although there is a slight chance of reaching the S1 threshold if any notable flares occur throughout the remainder of the period.

The high energy electron flux is expected to persist at normal background levels, given no notable changing events have occurred recently or are expected. Electron fluence levels are therefore expected to remain below the Active (1e8 pfu) threshold.

Figure 1. Solar Analysis Valid 25/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

No coronal hole fast winds feature in the forecast period. The 21 July CME should have arrived and has now been dismissed. It's not very clear as to what happened to it but two possibilities have been considered. This CME was perhaps far-sided or it caught up with an earlier and much slower one (19 July CME), along with a very slow background solar wind environment (~250 km/s), hence greatly reducing its arrival speed at Earth, as observed around 23/1948 UTC.

Another CME may give Earth a glancing blow. It originated from a long period M2.4 flare close to the southeast limb near AR3764 at 23/1430 UTC. This gave a wide and moderately fast CME, perhaps with low confidence of peripheral glancing impacts at Earth possible either late on Day 2 or early Day 3 (26/27 Jul).

Geomagnetic activity is expected to be mostly Quiet with a chance of Unsettled and Active intervals on Day 2 or early Day 3 (26/27 July) and a slight chance of G1/Minor storms.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	30	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

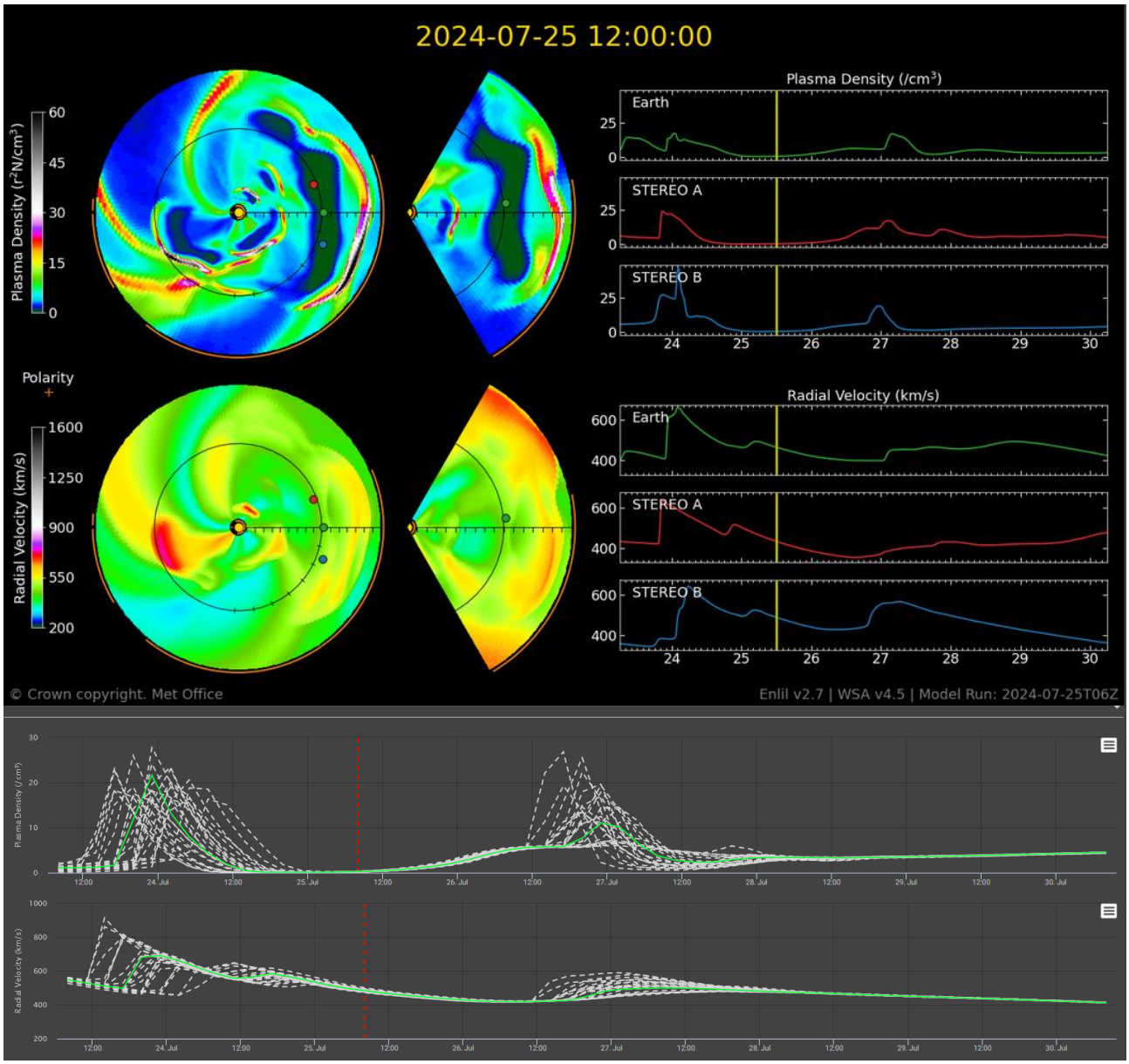
Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/2224	Partial	Filament eruption	SE quadrant	560 km/s	26/1500 UTC +/- 12 hrs	Low confidence due to location.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: MOSWOC Enlil and Ensemble showing a possible glancing blow late on 26 July or early on 27.



Radio Blackouts - X-Ray Flares:

Activity has been Moderate with an M3 flare observed at 24/1721 UTC from AR3751.

There are currently eleven sunspot regions on the solar disc. The two closely residing spots in the southwest have continued a slow decay, AR3751 has simplified, losing its gamma configuration, and AR3761 has shown some fading of trailing spots. AR3762 in the southwest approaching centre disk, is the largest and most complex spot, exhibiting proliferation in intermediate spots, with perhaps a tenuously weak delta spot present here alongside the well-established delta in the trailing region. AR3766 and the new region are two small and simple groups which have recently become evident near the eastern limb. All other remaining regions are small or simple.

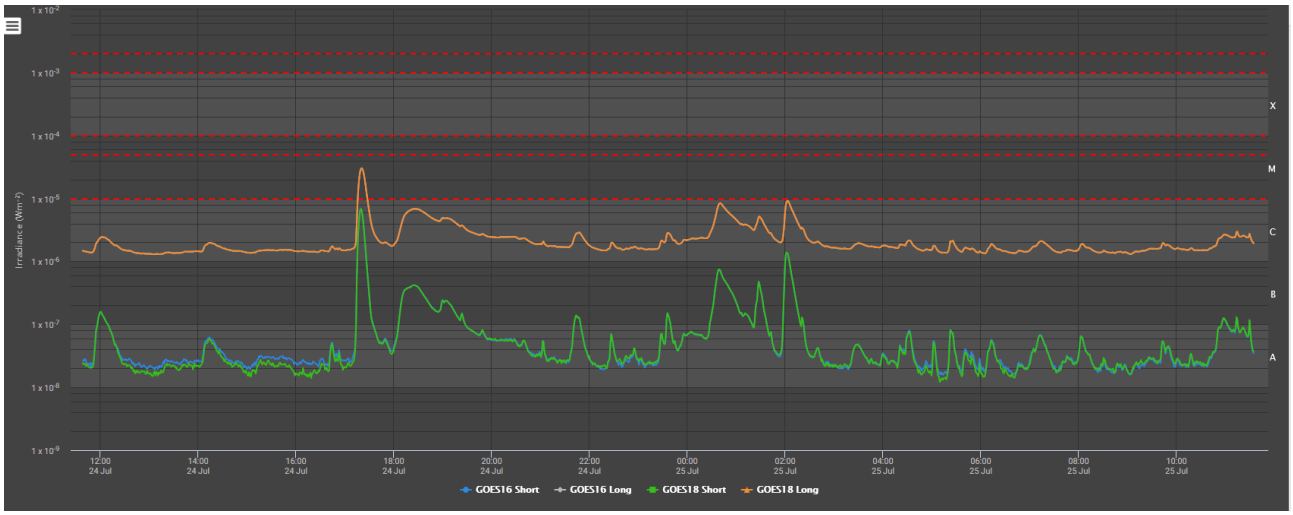
Activity is expected to be Low to Moderate with a chance of further M-class flares.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: Latest X-Ray flare activity as observed by GOES-18



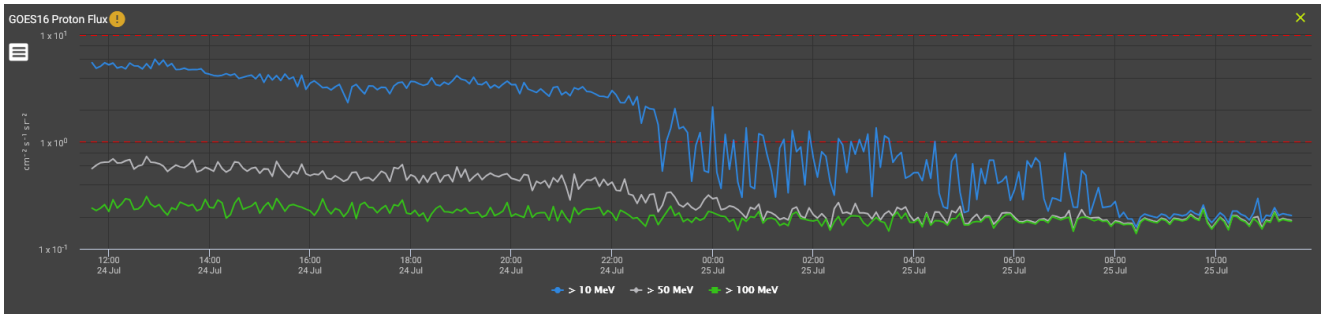
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
Proton levels have returned back to background levels. High energy proton levels are likely to remain at background levels, although there is a slight risk of reaching the S1 threshold if any notable flares occur throughout the remainder of the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Latest Proton Flux, as observed by GOES-16



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

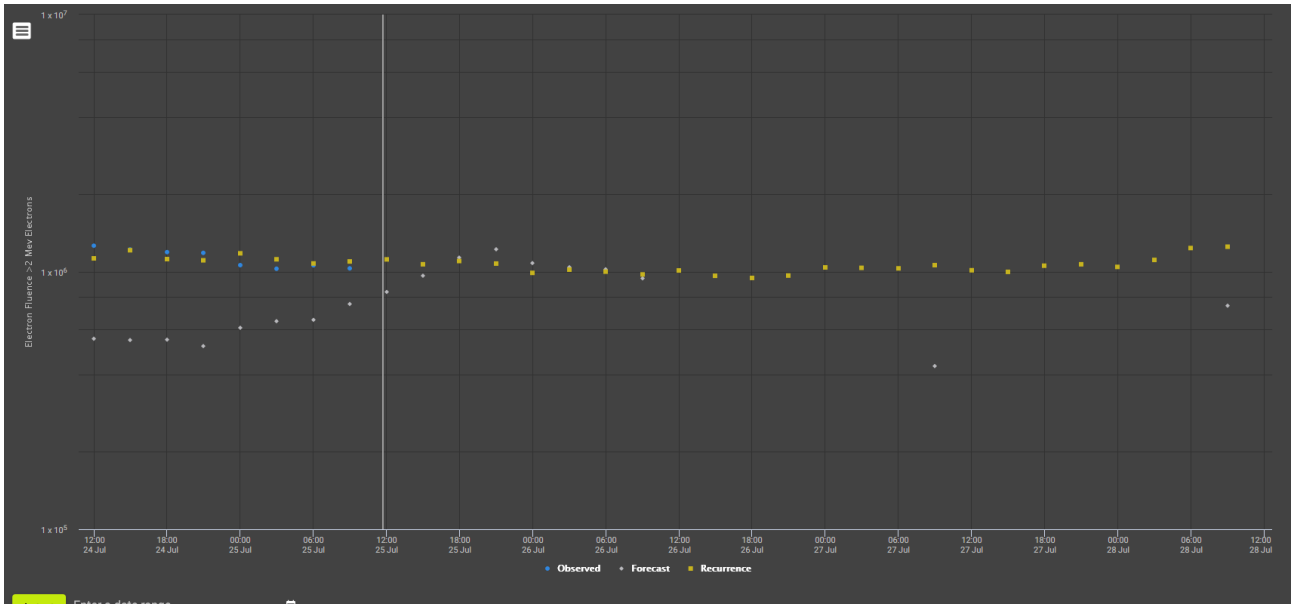
© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
The high energy electron flux as observed by GOES-16 is currently at background. Given the lack of any notable fast wind and any CME influence on Day 2 or 3 (26/27 July) expected to be relatively limited, background flux is forecast to persist.

The associated electron fluence is expected to persist below the Active level with MOSWOC REFM currently providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: Latest MOSWOC REFM output



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.